

Chapter 1

In-Class Problems

Name: _____

Date: _____ Per: _____

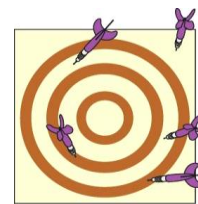
Section 1.4 – Uncertainty in Measurement

1. Compare and contrast accuracy and precision.

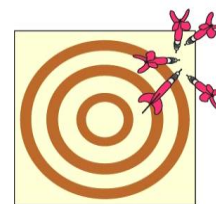
- Which set(s) of measurements are precise? _____
- Which set(s) of measurements are accurate? _____
- Which set(s) of measurements are both precise and accurate? _____

2. Explain the difference between an exact number and an inexact number.

- For each case, indicate whether the result is an exact or inexact number.
 - The number of faces: ☺ ☹ ☹ ☹ ☹ _____
 - The mass of six apples: _____
 - The number of seeds in an apple: _____
 - The number of feet in one mile: _____
 - The number of liters in five quarts: _____



(a)



(b)



(c)

Section 1.5 – Significant Figures and Calculations

1. Rules for Counting Significant Figures.

- Non-zero numbers are _____.
- Sandwich zeros are _____.
- Leading zeros are _____.
- Trailing zeros are significant _____.
- Exact numbers and counts _____.

EXAMPLE: Determine the number of sig figs in the following *quantities*:

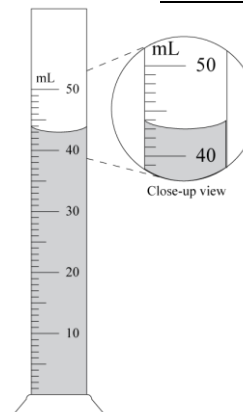
- | | |
|---------------------|-------------------------------|
| a. 3.82 L: _____ | d. 14 fingers: _____ |
| b. 24 m: _____ | e. 2.1×10^4 g: _____ |
| c. 0.0619 kg: _____ | f. 3.4610 km: _____ |

* as in $1 \text{ m} = 100 \text{ cm}$

- 100 cm^* : _____
- 22 apples: _____
- 712000 cm : _____

2. Read the device at right and complete the following.

- The name of this device is a(n) _____.
- The volume of the liquid should be recorded as _____.
- _____ significant digits should be recorded for this measurement.



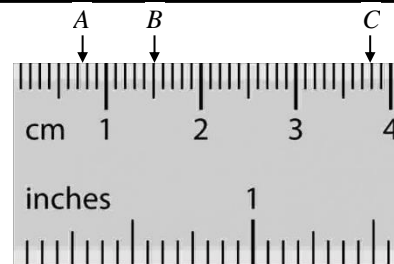
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3. Answer the following about the ruler shown.
- a. What values in cm would be recorded for A, B, and C?
 A: _____ B: _____ C: _____
- b. How many sig figs does each measurement have?
 A: _____ B: _____ C: _____



Calculations with Sig Figs

In mathematical operations involving significant figures, the answer is reported in a way that reflects the reliability of the *least precise* number. **An answer is no more precise than the least precise number used to get the answer.** Imagine a team race where you and your teammates must finish together at the same time. Who dictates the speed of the team? Of course, the slowest member of the team. Your answer cannot be more precise than the least precise measurement.

Careful!! -- The rules for addition/subtraction are different from those of multiplication/division
 Another note – In chemistry, we report answers with decimals, not fractions.

Multiplication & Division

The answer can contain no more significant sig figs than the measurement from the problem with the fewest sig figs.

Example

$$13.1 \times 1.2039 = 15.77109 = 15.8$$

3 SF's 5 SF's 3 SF's

The answer has 3 SF's since the measure with the fewest SF's has 3.

Addition & Subtraction

The answer must be rounded off to contain only as many decimal places as the measurement reported to the least precise decimal place.

Example

$$350.04 + 720 = 1070.04 = 1070$$

100th's 10's 10's
place place place

Since the least precise measurement was made to the 10's place, the answer must be rounded to the 10's place.

When doing multi-step calculations, keep at least one more SF in intermediate results than needed in final answer (or maintain SF's in calculator throughout calculation). Round only at the very end.

EXAMPLE: Perform the following calculations.

a. $\frac{239.1 \times 46.23 \times 0.00290}{16.508 \times 114.29} =$

b. $2342 \times 11.3 =$

c.
$$\begin{array}{r} 27.14 \\ 9224.8 \\ \hline 5.7567 \\ + 948.84 \\ \hline = \end{array}$$

d.
$$\begin{array}{r} 148.77 \\ -106.409 \\ \hline = \end{array}$$

Section 1.7 – Dimensional Analysis

| USCS / SI Conversions | Length | Mass | Volume |
|-----------------------|----------------|-----------------|-----------------------------|
| | 1 m = 1.094 yd | 1 kg = 2.205 lb | 1 L = 1.06 qt |
| | 2.54 cm = 1 in | 453.6 g = 1 lb | 1 ft ³ = 28.32 L |

Don't bother writing these down.

| SI Prefixes | Prefix | Symbol | Meaning |
|--------------|---------------|--------|---------------|
| | <i>giga-</i> | G- | 1 000 000 000 |
| | <i>mega-</i> | M- | 1 000 000 |
| | <i>kilo-</i> | k- | 1000 |
| | <i>hecto-</i> | h- | 100 |
| <i>deka-</i> | da- | 10 | |

Base Unit

| Prefix | Symbol | Meaning |
|---------------|--------|-----------------|
| <i>deci-</i> | d- | 1/10 |
| <i>centi-</i> | c- | 1/100 |
| <i>milli-</i> | m- | 1/1000 |
| <i>micro-</i> | μ- | 1 / 1 000 000 |
| <i>nano-</i> | n- | 1/1 000 000 000 |

Memorize these!

1. A pencil 7.00 inches long. What is its length in centimeters?

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- The speed limit on many highways in the US is 55 mph. What would the number be in km per hour?
- A Japanese car is advertised as having a gas mileage of 15 km/L. Convert this rating to miles per gallon.
- The latest model Corvette has an engine with a displacement of 6.20 L. What is it in cubic inches?
- The density of concentrated sulfuric acid is 1.84 g/mL. Concentrated sulfuric acid is 95 % pure sulfuric acid. What volume of concentrated sulfuric acid contains 100 g of pure sulfuric acid?

Section 1.9 – Density

Figure 1 shows a glass cylinder containing four liquids each of different density. Two of the liquids have been identified. A table containing a list of substances and their density (at 25°C) has been provided. From the list select a substance for Liquid #1 and Liquid #3. Briefly explain the reason(s) for your selections and for the remaining substances the reason they were not selected.

| Substance | Density (g/mL) |
|-----------------------------|----------------|
| Mercury | 13.5 |
| Water (polar) | 1.0 |
| Hexane (non-polar) | 0.660 |
| Ethyl alcohol(polar) | 0.789 |
| Dichloromethane (non-polar) | 1.33 |
| Aluminum | 2.699 |
| Bromine(non-polar) | 2.928 |
| Gold | 19.3 |

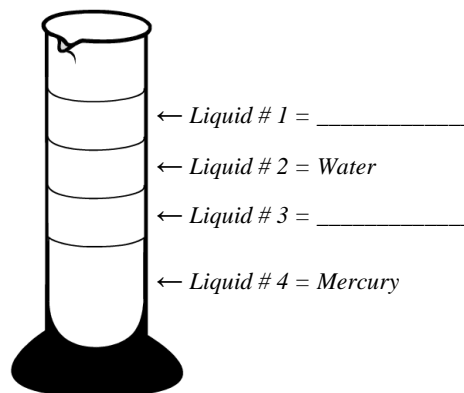


Figure 1

Liquid 1 Explanation: _____

Liquid 3 Explanation: _____

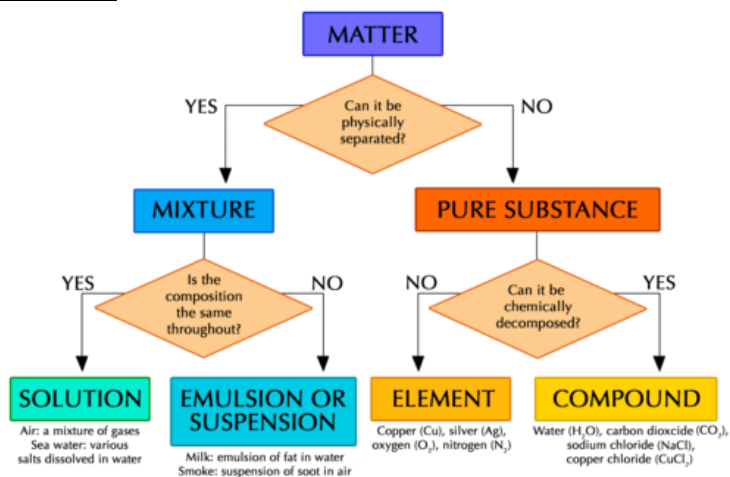
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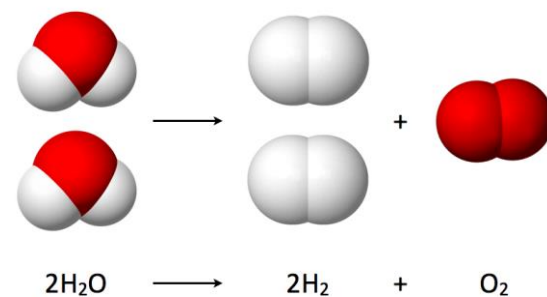
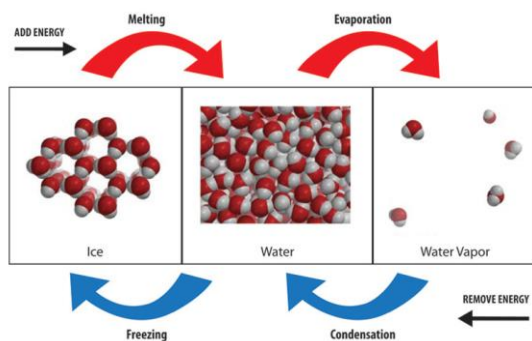
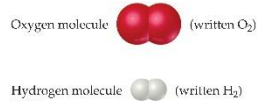
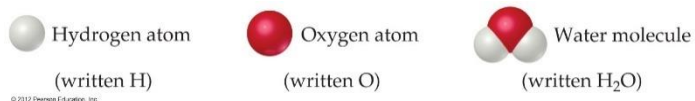
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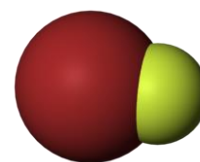
Section 1.10 – Classification of Matter



A. Particulate Diagrams (Very Important!)



- The model at right represents bromine fluoride, a highly unstable interhalogen compound. Which of the atoms represents the bromine atom? Explain how you determined this and why the two halogens are not identical.



- Draw a particulate diagram of sodium chloride.

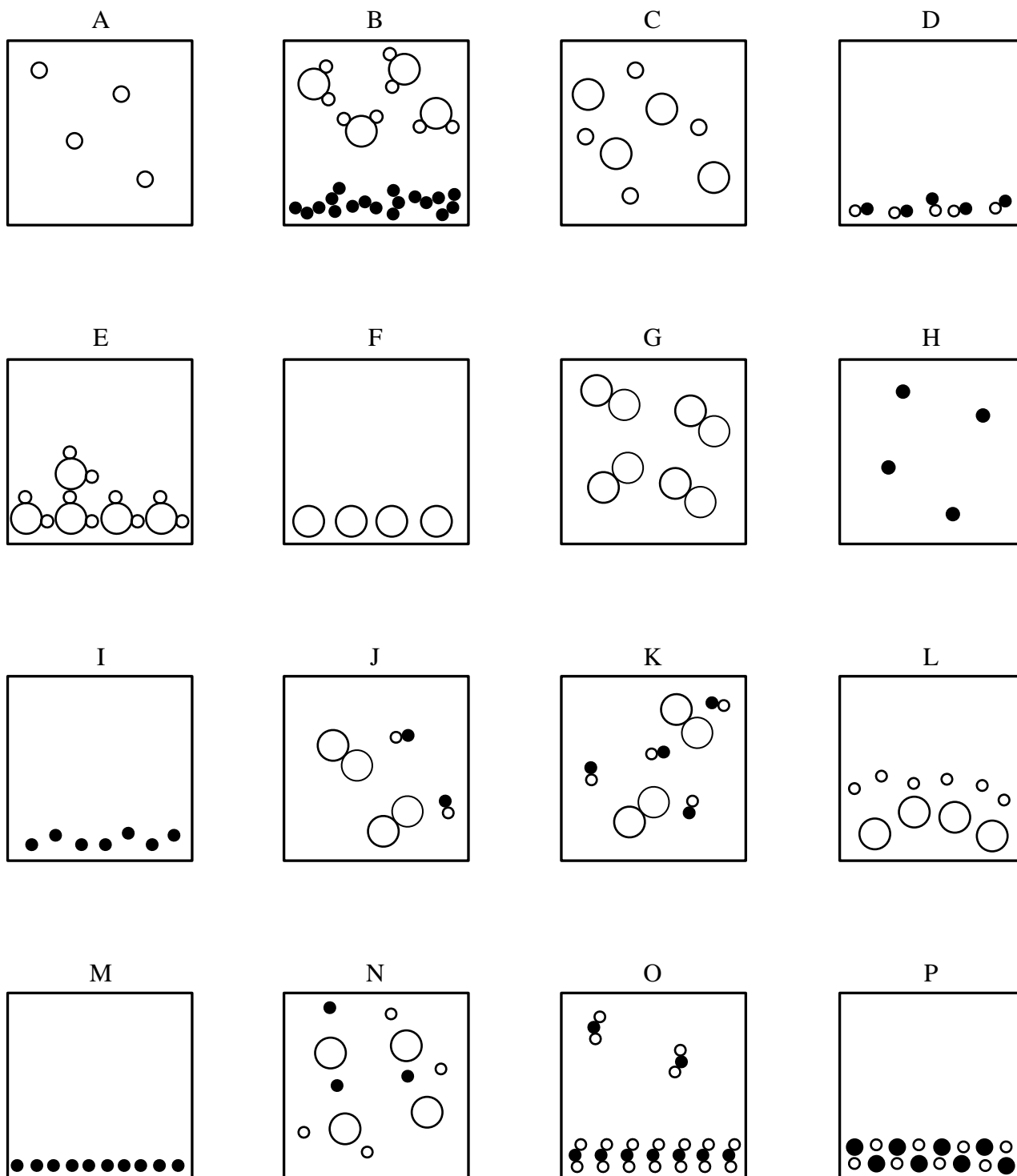
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3. Each diagram (A – P) shows a sample of substances as viewed at the atomic level. Characterize the contents of the container in terms of each of the following categories:
- Category I: Homogeneous mixture, heterogeneous mixture or pure substance
- Category II: Element(s), compound(s) or both
- Category III: Solid, liquid, gas or combination of phases



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B. Separation of Mixtures

1. For each of the separation techniques listed below, describe each and how it is used to separate the components of a mixture.

| Process | Diagram | Description |
|--------------|---------|-------------|
| Decantation | | |
| Filtration | | |
| Evaporation | | |
| Distillation | | |

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| | | |
|------------------------------|-------------------------------------|--|
| Paper chromatography | <p>Simple chromatography</p> | |
| Column chromatography | | |

2. Using only the following equipment, **briefly and neatly** describe how you would separate a mixture of iron filings, sand, and table salt. Indicate which equipment you use in each step of your procedure. Complete sentences NOT required. Flow charts accepted.

Funnel
Filter paper
Water

Stir rod
Magnet
Evaporating Dish

Hot Plate
Beakers